

XLVII.—*Conspectus of the Suborders, Families, and Genera of Chiroptera arranged according to their Natural Affinities.* By G. E. DOBSON, M.A., M.B., F.L.S., &c.

THE system of classification described in this paper having been adopted by me in the MS. of my descriptive Catalogue of the Asiatic Chiroptera, I here anticipate its publication, with the view of expressing more fully my reasons for classifying the genera according to a plan differing in some important points from those previously used*, and also for the purpose of pointing out some important structural characters, of great value in the systematic arrangement of the families and genera, hitherto either unnoticed or insufficiently recognized.

The Chiroptera fall naturally into two subdivisions which may be called suborders, hitherto known as *Chiroptera frugivora* and *Chiroptera insectivora*; but as those names have not been framed in accordance with the accepted rules of zoological nomenclature, and as, moreover, the second part of the name of the second suborder has been previously applied to an order of Mammals, I use here instead the terms *Megachiroptera* and *Microchiroptera* to express these divisions respectively. These terms are relatively correct; for, although some species of the Carnivorous Bats very much exceed in size many species of the Frugivorous, nevertheless the Frugivorous Bats taken collectively are very much larger than the Carnivorous, contrasting with them in size almost to the same extent as, among other Mammals, the Ungulata contrast with the Carnivora.

Order CHIROPTERA.

Suborder I. MEGACHIROPTERA.

Crowns of the molar teeth smooth, marked with a longitudinal furrow; bony palate continued behind the last molar, narrowing slowly backwards; index finger generally terminating in a claw; sides of the ear-conch forming a complete ring at the base; *pyloric* extremity of the stomach greatly elongated.

Frugivorous.

Limited to the tropical and subtropical regions of the eastern hemisphere and Polynesia.

* Two complete systems only, of classifying the genera of Chiroptera, have been published—that of Prof. Peters in 1865 (MB. Akad. Berlin, 1865, p. 256), and that by Dr. J. E. Gray in a series of papers to be found in the 'Ann. & Mag. Nat. Hist.' and in the 'Proc. Zool. Soc. Lond.' for 1866.

Suborder II. **MICROCHIROPTERA.**

Crowns of the molar teeth acutely tubercular, marked by transverse furrows; bony palate narrowing abruptly, not continued laterally behind the last molar; index finger generally terminating in a claw; sides of the ear-conch commencing anteriorly from separate points of origin; stomach simple, or with the *cardiac* extremity more or less expanded or elongated.

Carnivorous, feeding principally upon insects*.

Inhabiting the tropical and temperate regions of both hemispheres.

Suborder I. **MEGACHIROPTERA.**Family I. **Pteropidæ.***Synopsis of Groups of Allied Genera.*

- A. Tongue moderate; molars well developed. Group 1. **PTEROP1.**
(Pteropus, Brisson; Cynopterus, F. Cuvier; Cynonycteris, Peters; Harpyia, Illiger; Epomophorus, Bennett; Cephalotes, Geoff.)
- B. Tongue very long; molars weak, scarcely elevated above the gum Group 2. **MACROGLOSS1.**
(Macroglossus, F. Cuvier; Eonycteris, Dobson; Notopteris, Gray.)

Suborder II. **MICROCHIROPTERA.***Analytical Table of Natural Families.*

- A. Tail contained within the interfemoral membrane.
- a. Middle finger with two phalanges†.
- a'. First phalanx of the middle finger extended (in repose) in a line with the metacarpal bone.
- a''. Nostrils opening in a depression on the upper surface of the muzzle, surrounded by foliaceous cutaneous appendages.
- a'''. Tragus none; premaxillary bones rudimentary, represented by thin osseous laminæ suspended from the nasal cartilages in the centre of the space between the canines. **Rhinolophidæ.**

* Some species of Phyllostomidæ, especially the species of the group *Stenodermata*, have been shown to be frugivorous; but they are probably carnivorous also. In form their teeth in no respect resemble those of *Megachiroptera*; but the true molars, in their narrow external cutting-edges, resemble those of *Carnivora* even more so than those of the truly insectivorous species with their W-formed cusps.

† Except in *Thyroptera tricolor* and in *Mystacina tuberculata*.

b'''. Tragus distinct; premaxillary bones cartilaginous or small, separated by a space in front.

Nycteridæ*.

b''. Nostrils opening by simple crescentic or circular apertures at the extremity of the muzzle, not surrounded by distinct foliaceous cutaneous appendages†; premaxillary bones small, lateral, separated by a wide space in front; tragus distinct **Vespertilionidæ.**

B. Tail perforating the interfemoral membrane and appearing on its upper surface, or produced considerably beyond the truncated membrane‡.

b'. First phalanx of the middle finger folded (in repose) on the dorsal surface of the metacarpal bone§.

c''. Nostrils opening by simple circular or valvular apertures, not surrounded by foliaceous cutaneous appendages; tragus distinct **Emballonuridæ||.**

b. Middle finger with three phalanges; first phalanx of the middle finger short; nostrils in the front part of the cutaneous nasal appendages, or opening by simple apertures at the extremity of the muzzle; chin with warts or erect cutaneous ridges; premaxillary bones well developed, united in front.

Phyllostomidæ.

Synopsis of Subfamilies.

Rhinolophidæ.

I. Toes unequal, first toe with two, remaining toes with three phalanges each; ilio-pectineal spine not connected by bone with the antero-inferior surface of the ilium. . . **Rhinolophinæ.**

II. Toes equal, of two phalanges each; ilio-pectineal spine united by a bony isthmus with a process derived from the antero-inferior surface of the ilium, forming a large preacetabular foramen **Phyllorhininæ.**

Nycteridæ.

I. Nostrils at the bottom of a concavity on the extremity of the muzzle, concealed by the base of an erect cutaneous process; tail very short, in the base of the large interfemoral membrane; premaxillaries cartilaginous **Megaderminæ.**

II. Nostrils at the anterior extremity of a deep longitudinal facial groove; tail long, produced to the hinder margin of the interfemoral membrane **Nycterinæ.**

* Nycteridæ = Megadermata, Peters (in part.), *l. c.*

† A rudimentary nose-leaf in *Nyctophilus* and in *Antrozous*.

‡ In *Macrotus*, *Macrophyllum*, and *Lonchorina* alone the tail is contained in the interfemoral membrane.

§ Except in *Noctilio* and in *Mystacina*.

|| Emballonuridæ = Brachyura et Molossi, Peters, *l. c.*

Vespertilionidæ.

Not divisible into subfamilies.

Emballonuridæ.

- I. Tail slender, perforating the interfemoral membrane and appearing upon its upper surface; legs long, fibula very slender; premaxillary bones generally separated by an interval in front; incisors weak **Emballonurinae.**
- II. Tail thick, produced considerably beyond the short interfemoral membrane*; legs very short and stout; fibula well developed; premaxillary bones close together in front or united; upper incisors strong **Molossinae** †.

Phyllostomidæ.

- I. Nostrils on the upper surface of the muzzle, surrounded by cutaneous appendages; chin with warts **Phyllostominae.**
- II. Nostrils in the front of the muzzle, opening by simple apertures near the margin of the upper lip; chin with erect cutaneous ridges **Lobostominae.**

*Synopsis of Groups of Allied Genera.***Fam. Rhinolophidæ.****Genera.**

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|-------------------------------------|---|------------------------------|
| Subfam. Phyllorhininae | { | <i>Caelops</i> , Blyth. |
| | | <i>Phyllorhina</i> , Bonap. |
| | | <i>Rhinonycteris</i> , Gray. |
| | | <i>Tricenops</i> , Dobson. |
| Subfam. Rhinolphinae | | <i>Rhinolophus</i> , Geoffr. |

Fam. Nycteridæ.

- | | |
|-----------------------------------|----------------------------|
| Subfam. Nycterinae | <i>Nycteris</i> , Geoffr. |
| Subfam. Megaderminae | <i>Megaderma</i> , Geoffr. |

Fam. Vespertilionidæ.

- A. Crown of the head flat or slightly raised above the face-line; upper incisors close to canines.

- a. Ears very large, generally united.

Group **PLECOTI**

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|---|--------------------------------|
| { | <i>Antrozous</i> , Allen. |
| | <i>Nyctophilus</i> , Leach. |
| | <i>Otonycteris</i> , Peters. |
| | <i>Corinorhinus</i> , Allen. |
| | <i>Plecotus</i> , Geoffr. |
| | <i>Synotus</i> , Keys. & Blas. |
| | <i>Histiotus</i> , Gervais. |

* Except in *Mystacina tuberculata*.

† These subfamilies nearly correspond to the families Brachyura and Molossi of Peters, and to the Vespertilionidæ (in part) and Noctilionidæ of Gray. The genera of Emballonuridæ, however, with the exception of *Rhinopoma* and *Noctilio*, are so connected that any attempt to divide them into subfamilies must be very artificial. The genera fall naturally into six groups, which I shall define further on.

- b.* Ears moderate, separate.
- Group VESPERTILIONES
- Vesperugo*, Keys. & Blas.
Chalinolobus, Peters.
Scotophilus, Leach.
Nycticejus, Rafinesque.
Atalapha, Rafinesque.
Murina, Gray.
Vespertilio, Keys. & Blas.
Kerivoula, Gray.

B. Crown of the head greatly elevated above the face-line; upper incisors separated from the canines, and also in front.

- Group MINIOPTERI..... {
 Natalus, Gray.
 Thyroptera, Spix.
 Miniopterus, Bonap.

Fam. Emballonuridæ.

Subfam. **Emballonurinae.**

- A. First phalanx of the middle finger folded (in repose) on the dorsal surface of the metacarpal bone; upper incisors weak.

- a. Frontal bones convex.

- tal bones convex.
- Group 1. EMBALLONURÆ { *Furia*, F. Cuvier.
Saccopteryx, Illiger.
Rhynchonycteris, Peters.
Emballonura, Temm.

- b.* Frontal bones with a distinct concavity.

- α' . Premaxillary bones separate in front.

- front.
- Group 2. TAPHOZOI { Colëura, Peters.
Taphozous, Geoffr.
Dichidurus, Wied.

- b'*. Premaxillary bones united.

- Group 3. RHINOPOMA *Rhinopoma*, Geoffr.

- B. First phalanx of the middle finger extended (in repose) in a line with the metacarpal bone; upper incisors strong.

- Group 4. NOCTILIONES *Noctilio*, L.

Subfam. **Molossinæ.**

- C. First phalanx of the middle finger folded (in repose) on the dorsal surface of the metacarpal bone; upper incisors large, well developed.

- Group 5. *MOLOSSI* { *Mormopterus*, Peters.
Molossus, Geoffr.
Nyctinomus, Geoffr.
Cheiromdes, Horsf.

- D. First phalanx of the middle finger folded (in repose) on the inferior surface of the metacarpal bone; tail perforating the interfemoral membrane; upper incisors strong, well developed.

- Group 6. MYSTACINÆ..... *Mystacina*, Gray.

Fam. **Phyllostomidæ.**Subfam. **LOBOSTOMINÆ.**

- Group 1. MORMOPES { *Chilonycteris*, Gray.
Pteronotus, Gray.
Mormops, Leach.

Subfam. **PHYLLOSTOMINÆ.**

A. True molars present ; upper incisors 4.

a. Muzzle long ; outer side of true molars with W-formed cusps.

- a'. Tongue moderately long, terminating in an obtuse tip ; upper surface of the lower lip not divided in the centre. { *Macrotus*, Gray.
Lonchorhina, Tomes.
Macrophyllum, Gray.
Vampyrus, Geoffr.

- Group 2. VAMPYRI { *Schizostoma*, Gervais.
Lophostoma, D'Orb.
Trachyops, Gray.
Phyllostoma, Peters.
Carollia, Gray.
Rhinophylla, Peters.

b'. Tongue very long, much attenuated towards the tip ; upper surface of the lower lip divided by a deep groove in the centre.

- Group 3. GLOSSOPHAGÆ { *Glossophaga*, Pall.
Monophyllus, Leach.
Ischnoglossa, Sauss.
Phyllonycteris, Gundl.
Lonchoglossa, Peters.
Glossonycteris, Peters.

b. Muzzle short, broad and obtuse ; outer side of true molars with a notched cutting-edge.

- Group 4. STENODERMATA { *Artibeus*, Leach.
Phyllops, Peters.
Vampyrops, Peters.
Stenoderma, Geoffr.
Pygoderma, Peters.
Ametrida, Gray.
Chiroderma, Peters.
Sturnira, Gray.
Brachyphylla, Gray.
Centurio, Gray.

B. No true molars ; upper incisors 2.

- Group 5. DESMODONTES { *Desmodus*, Wied.
Diphylla, Spix.

In the accompanying Diagram I have represented the families of Microchiroptera diverging along two distinct lines of descent from some ancestral group now extinct, which I have for convenience designated Palæochiroptera. These allied families form two natural alliances, which may be called the Vespertilionine and Emballonurine alliances respectively ; and these alliances correspond very closely to their geographical distribution, to which I shall refer particularly hereafter.

The Vespertilionidæ and Emballonuridæ are evidently connected through the genera included in the groups Miniopteri and Emballonuræ, more particularly by the genera *Natalus* and *Furia*—not directly, however, but most probably through the family or group, now extinct, referred to above.

Pteropidæ.**

Glossophagæ.

Vampyri.

PHYLLOSTOMINÆ.

Stenodermata.

Desmodontes.

Phyllostomidæ.†

Emballonuridæ.

o the Eastern Hemisphere.

o America.

o the Eastern Hemisphere and Polynesia.

ups, and genera not distinguished by a mark, as above, are found in
es.

of the circle representing the *Pteropidæ* is not intended (as in other
te their descent from the *Phyllostomidæ*, but to show their position
the whole suborder *Microchiroptera*.

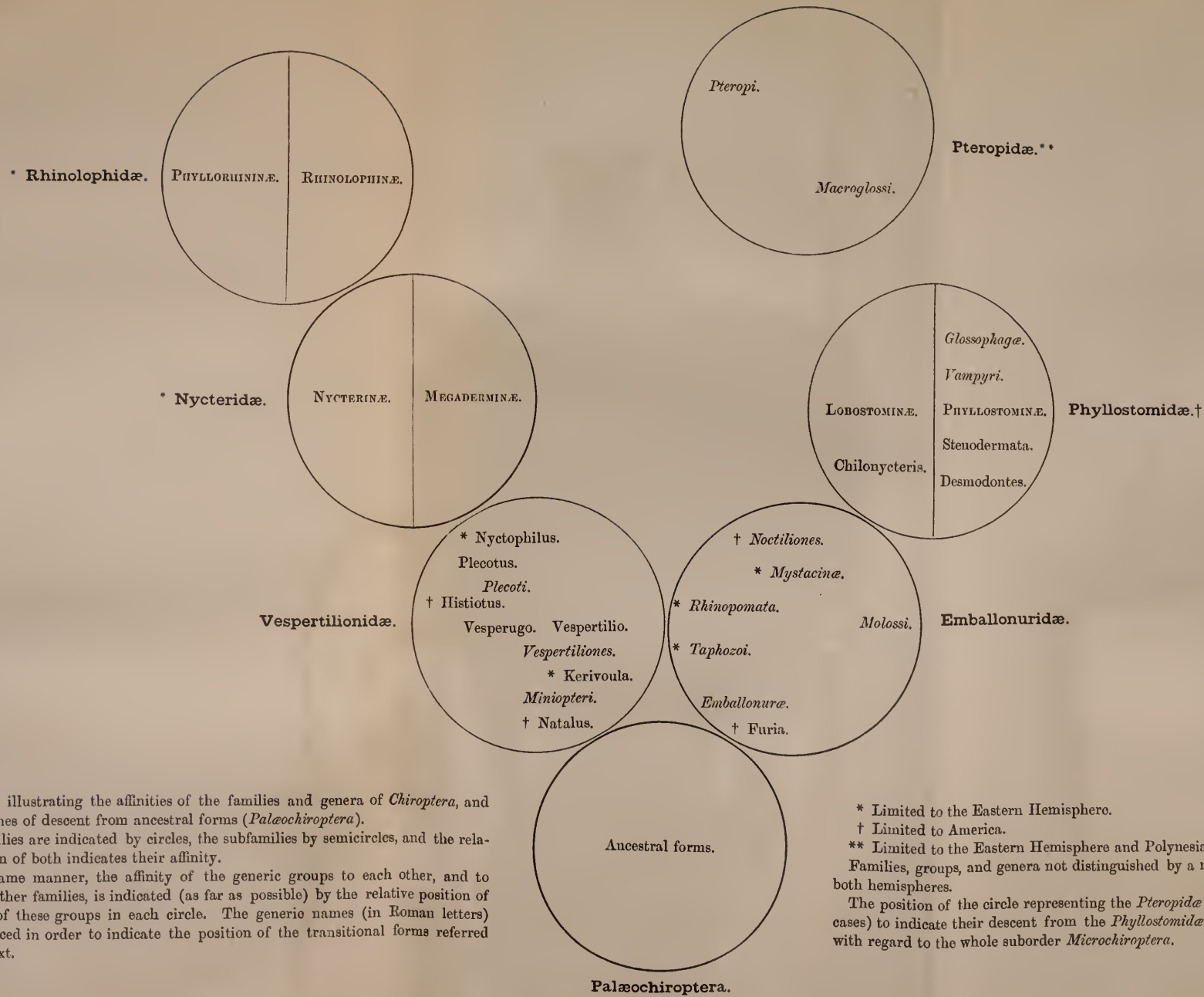


Diagram illustrating the affinities of the families and genera of *Chiroptera*, and probable lines of descent from ancestral forms (*Palæochiroptera*).

The families are indicated by circles, the subfamilies by semicircles, and the relative position of both indicates their affinity.

In the same manner, the affinity of the generic groups to each other, and to groups of other families, is indicated (as far as possible) by the relative position of the names of these groups in each circle. The generic names (in Roman letters) are introduced in order to indicate the position of the transitional forms referred to in the text.

* Limited to the Eastern Hemisphere.

† Limited to America.

** Limited to the Eastern Hemisphere and Polynesia.

Families, groups, and genera not distinguished by a mark, as above, are found in both hemispheres.

The position of the circle representing the *Pteropidæ* is not intended (as in other cases) to indicate their descent from the *Phyllostomidæ*, but to show their position with regard to the whole suborder *Microchiroptera*.

THE VESPERTILIONINE ALLIANCE.

(Vespertilionidæ, Nycteridæ, Rhinolophidæ.)

Analysis of Natural Affinities.

In some specimens of *Plecotus auritus* the glands on the sides of the muzzle, between the nostrils and the eyes, form rounded prominences, rising slightly above the margins of the naked crescentic depressions behind the nostrils. These prominences in a closely allied genus (*Corinorhinus*) are greatly developed vertically, forming high conical processes on the sides of the face, which processes, bending inwards over the nasal grooves, meet in the centre above and behind the nostrils, concealing the grooves beneath. In front the nasal apertures are margined by a small horizontal cutaneous ring. In *Nyctophilus* (which is closely connected with *Plecotus* and *Synotis*) the same prominent glands of the muzzle have become united in the centre above the nasal grooves (evidence of their distinct origin being given by the presence of a longitudinal furrow above); while the cutaneous marginal rings surrounding the nasal apertures in *Corinorhinus* have become expanded and also united behind, forming a small nose-leaf, which is supported behind by the united glandular prominences*.

In the much more highly differentiated nasal processes of *Megaderma*, especially in *M. spasma*, the homologies of these parts with the glandular prominences and rudimentary nose-leaf of *Nyctophilus* will be readily recognized. But *Megaderma* shows its affinities to the Rhinolophidæ in the peculiar pubic appendages and in the form of the wings and ears—indeed, by many zoologists has been placed in that family; and the very complicated nasal appendages of *Rhinolophus* are evidently but differentiated forms of the simpler nose-leaves of *Nyctophilus* and of *Megaderma*†.

Thus the intimate connexion of the genera of the three families constituting what I have called the Vespertilionine alliance can be traced through *Plecotus*, *Nyctophilus*, and *Megaderma*; and this view of their relations is still further

* In a similar manner most probably the nasal appendages in all genera of Chiroptera with nose-leaves have been developed.

† *Nyctophilus* is much more closely related to *Plecotus* than to *Megaderma* or to *Nycteris*. This is shown by the skull, which, when compared with that of *Plecotus*, presents differences which would scarcely warrant generic separation if taken alone. Prof. Peters has pointed out the affinities of *Antrozous* with *Nyctophilus*, the skulls and skeletons of which scarcely differ. Consequently *Antrozous* cannot be placed among the Nycteridæ, though differing from all genera of Vespertilionidæ in possessing four lower incisors only.

strengthened by an examination of the minute structure of the hairs composing the fur, which will be found to agree in a very remarkable manner in these families, and to differ not less remarkably from that in the allied genera united in what I have termed

THE EMBALLONURINE ALLIANCE.

(Emballonuridæ, Phyllostomidæ.)

Analysis of Natural Affinities.

The Vespertilionidæ are connected with the Emballonuridæ by *Miniopterus*, which agrees with all the genera in the shortness of the first phalanx of the middle finger; with the genus *Furia* in the great elevation of the crown of the head, in the position and form of the upper incisors, and in the tail, which ends in the interfemoral membrane, not even the extreme tip projecting. *Natalus* also resembles *Furia* closely in the very short thumb, in the peculiar form of the tragus, and in the tenuity and venation of the membranes.

The very peculiar genus *Rhinopoma*, which I have placed in a separate group, is connected apparently more closely with *Taphozous* than with any other genus. The very long tail, produced nearly double its length beyond the short truncated interfemoral membrane, really perforates the membrane (as in other species of the subfamily Emballonuridæ) near its posterior margin; and the short first phalanx of the middle finger is imperfectly flexed upon the dorsal surface of the metacarpal bone, as in *Furia*—thus also agreeing with other species of this subfamily except *Noctilio*. If *Rhinopoma Hardwickii* and *Taphozous nudiventris*, which inhabit the same regions, be compared, the general resemblance of these generically very distinct forms is sufficiently evident. Both agree in the frontal depression between the eyes, in the *quality and distribution of the fur*, in the great deposits of fat about the base of the tail; while *Rhinopoma* agrees generally with the genus *Taphozous* in the form of the foot and in the presence of a few scattered long hairs near the extremity of the tail. This last-named character may appear to be a superficial one; but I consider it very indicative of affinity. The position of this very curious genus (which differs from all the Microchiroptera in possessing two distinct phalanges in the index finger, as in the Megachiroptera) among the Emballonuridæ is further shown by the microscopical characters of the fur, in which it agrees with that family and with the Phyllostomidæ, and differs from all species of the Vespertilionine alliance. The presence of a small nose-leaf, the longitudinal fissure on the muzzle, the

shortness of the middle finger, and the existence of a pair of abdominal (not pubic) appendages (like those in *Megaderma*, but smaller) connect this remarkable genus with the Nycteridæ.

Mystacina, represented by *M. tuberculata* (Gray), Tomes, from New Zealand, connects the *Emballonurinae* with the *Molossinae*. It possesses characters common to both subfamilies, resembling the species of the first in the form of the ears and in the short tail perforating the interfemoral membrane, the second in dentition and in the general form of the body; so that its position is clearly among the *Molossinae*. Unlike the other genera of *Emballonuridæ*, the middle finger has three phalanges, as in *Thyroptera* among the *Vespertilionidæ*, and the first phalanx is flexed downwards upon the metacarpal bone.

Noctilio connects the *Emballonuridæ*, especially the subfamily *Emballonurinae*, with the *Phyllostomidæ* through the *Lobostominae*. I have placed *Noctilio* provisionally in this family; for its affinities appear to me to be with *Chilonycteris* and the genera allied thereto. These affinities are shown by the presence of a small incisor on each side external to the large central upper incisors, by the development of the mastoid and paroccipital processes, by the short first phalanx of the middle finger, which is not flexed upwards (in repose) on the dorsal surface of the metacarpal bone (as in other species of *Emballonuridæ*), and by the erect cutaneous ridges on the chin, and especially by the form of the nostrils and ears and by the microscopical characters of the fur.

The *PHYLLOSTOMIDÆ* are divisible into two subfamilies, the *Lobostominae* and the *Phyllostominae*:—the first containing the genera *Chilonycteris*, *Pteronotus*, and *Mormops*, united by Prof. Peters into a group *Mormopes*; the second the remaining genera of the family. If the genus *Noctilio* were placed among the *Lobostominae*, it would form a separate group distinguished by the presence of two phalanges only in the middle finger.

I have followed Prof. Peters's divisions of the genera of *Phyllostominae*, retaining his names of subfamilies for what I consider groups of allied genera*. Between these groups transitional forms exist, which have not yet been found between the *Phyllostominae* and the *Lobostominae*. Thus *Rhinophylla* leads from the *Vampyri* to the *Glossophagæ*; and the close connexion of the *Vampyri* with the *Stenodermata* is seen in the similarity of the warts of the lower lip. *Brachyphylla* is evidently so closely related to *Desmodus* that it appears diffi-

* Prof. Peters has devoted so much attention to the *Phyllostomidæ*, and his knowledge of the species of this family is so profound, that I hesitate to make any change in his system of grouping the genera.